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Abstract

THE IRRADIATION BEHAVIOUR OF GRAPHITE

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Experimental results on the effects of irradiation on graphite in the temperature range 150-650°C are described. Samples of Grade A reactor graphite have been irradiated in high flux reactors and measurements made of the changes in thermal conductivity, thermal expansion, Young's modulus and dimensions. The changes in thermal expansion and dimensions of pyrolytic graphite were also measured. As far as these properties are concerned, it is considered that the results give a good representation of the behaviour of the crystals of which reactor graphite is composed and the dimensional changes of pyrolytic graphite are compared with values for the dimensional changes of graphite crystals, inferred from measurements on reactor graphite.

The results of recent work on the structure of radiation defects in graphite are also summarised. Thin film electron microscopy has yielded a considerable amount of direct information on the properties of large interstitial clusters and some of the properties of vacancies and small interstitial clusters can be inferred. The results of the irradiation experiments are interpreted in terms of a radiation damage model, formulated on the basis of the new information on defect structures.

This work extends the data on the behaviour of reactor graphite over a sufficiently wide range of temperature and dose to cover almost the complete life of the reactors in the first stage of the United Kingdom's power programme, and improved understanding of the mechanisms involved has enabled methods of allowing for differences in temperature and flux level to be developed.

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